DOCUMENT RESUME

ED 480 978 SE 066 570

AUTHOR	Thompson, Anthony D.
TITLE	Mathematics Standards as Political Activity.
PUB DATE	2002-00-00
NOTE	11p.; Paper presented at the International Conference on Mathematics Education and Society (MES3) (3rd, Helsingor, Denmark, April 2-7, 2002).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Case Studies; Educational Change; *Mathematics Education; Science Education; *State Standards
IDENTIFIERS	*Florida

ABSTRACT

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Anthony D. Thompson

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Mathematics standards as political activity

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Despite most US states developing new mathematics standards to serve as the cornerstone of their education reform efforts, little is known how standards are conceptualized, developed, and debated within political contexts. This paper provides a synopsis of a two-year case study on the development of Florida's mathematics standards. Florida first developed standards in 1994 where the writing team, consisting entirely of mathematics educators, strategically wrote the standards to convey their goals for reform in mathematics education. However, due to changes in the political context, these standards underwent major revisions from 1995-1996. This paper provides insight into Florida's political struggle to develop mathematics standards.

"What must be taught?" is a question that epistemology cannot answer but rather must find its answer in politics. (Philip H. Steedman, 1988, p. 135)

Introduction

The publication of the National Council of Teachers of Mathematics' (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (1989) set off a wave of standard setting among US states (Ravitch, 1995). Since determining curriculum is largely a political endeavor, there have understandably been disagreements over the development of mathematics standards. These "math wars," (see *Phi Delta Kappan*, Feb. 1999) include disputes over what standards should look like, what standards should contain, who should be involved in developing standards, and the role standards are suppose to play politically. Like several other US states, disagreement arose as Florida developed their mathematics standards in the mid-late 1990s.

This research provides insight into the political nature of standards development and shows that mathematics standards are imbued with greater intent and meaning that what may appear to non-mathematics educators. This paper explores the diverse rationales behind the development of Florida's mathematics standards, how this related to the debates over the standards, and the underlying political nature of standards development.

Methodology

Data collection occurred over a two-year period and included interviews, document analysis, and field observations. The participants included members of the mathematics writing team, Florida Department of Education (DOE) officials, numerous reviewers, and a variety of other Florida educators involved in writing, reviewing, or editing the mathematics standards. Data collection and analysis in this study occurred simultaneously. The interaction of data analysis with the gathering of data enabled me to refine interview questions and observation guides throughout the study, and clarify informants' accounts and

P. Valero & O. Skovsmose (2002) (Eds.). Proceedings of the 3rd International MES Conference. Copenhagen: Centre for Research in Learning Mathematics, pp. 1-9.

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information. Furthermore, the interaction between analysis and collection allowed me to check out working hypotheses that emerged from the data. (i.e., patterns / themes came from the data rather than being imposed on them prior to data collection and analysis). Triangulation, prolonged submersion / engagement at the research site, negative case analysis, and extensive member checking were used to help ensure the integrity of the research.

Theoretical framework

A symbolic interactionist theoretical framework (SI) was used to further refine my research focus. A more specific goal of this research was to understand the intent of the writers as they developed the mathematics standards and to place this within the larger historical and political context. A symbolic interactionist framework focuses attention on how individuals interpret and give meaning to their experiences, to other people, and to "objects" in their lives (in this case, mathematics standards), and endeavors to understand how this process of interpretation leads to particular behaviors (Jacob, 1987). From an SI perspective, standards are social constructions that result from the interplay of diverse political interests. This perspective encourages the collection of evidence that reveals the differing intents / interests of the participants (Hall, 1997), and focuses on the politics of meaning in standards development (Placier, 1998).

Education reform in Florida

Florida's education reform initiative, known as *Blueprint 2000*[1], was developed in 1991 and called for more local control but greater state accountability. However, what this new reform initiative should look like in practice and how it was to be achieved politically were unclear. As a result, policy specifics of *Blueprint 2000* were intensely debated between 1991 – 1994. The cornerstone of these debates focused on how to hold schools accountable and what to hold them accountable for.

In late 1993, the Florida DOE chose not to wait for policy specifics to be developed and decided to proceed with the development of new standards in all subject areas. Since assessment and accountability programs associated with *Blueprint 2000* were still being debated, the DOE advertised the new standards not as state mandates, but as professional recommendations from the subject areas. At the time, it was unknown how or even if these standards would be used for state level policies (e.g., state assessment). The state's mathematics curriculum specialist was asked to serve as editor of the mathematics standards and to select her own writing team.

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[1] Today, Blueprint 2000 is known *as The Florida Educational Reform and Accountability Act.*

Defining the Purpose of Standards

Given the political ambiguity created by on-going policy debates, the mathematics writing team had considerable leeway in determining the purpose of the standards. After numerous meetings, the writing team decided that the primary purpose of the standards should be to reform teaching rather than to delineate what students should know and be able to do. As a result, the standards were designed to facilitate reform in mathematics education by encouraging teachers to reconsider their views of mathematics and how it should be taught. Specific strategies were developed by the mathematics writing team to develop standards in order to convey their message of reform. Few other than the immediate writing team and a few "hand-picked" reviewers participated in this original effort to develop mathematics standards.

Strategies for developing standards to reform mathematics education included:

- using "action" verbs to promote changes in pedagogy and assessments practices;
- leaving out content specifics and writing broad standards to allow for classroom flexibility and to encourage local initiative; and
- avoiding words which could dissuade teacher change.

Using "action" verbs to promote reform

The writing team hoped that writing standards with "action" verbs would encourage teachers to broaden their view of mathematics from one of "computation, symbol manipulation, and drill and practice" to one of "problem solving, active exploration, and discussion" (writing team's characterizations). Examples of "action" verbs included: communicate, explore, investigate, analyze, justify, model, interpret, demonstrate, predict, verify, evaluate, design, and apply. For example: Students should be able to:

- Communicate the effects of addition and subtraction of whole numbers.
- Explore the attributes of two- and three-dimensional shapes.
- Investigate problems by generating, collecting, organizing, displaying and analyzing data. (Florida DOE, March 1995)

The writing team also viewed assessment as a part of curriculum and instruction thus making assessment reform an integral part of the intent of the standards. The writing team hoped that their standards would encourage teachers to try alternative assessments. For example, how would a teacher know if a student has "achieved" the following standard?

> Students will be able to investigate the order of whole numbers, commonly used fractions, and decimals, and explore their inter-relationships (Florida DOE, March 1995)

To assess this standard would require students actually engage in "investigating" and "exploring inter-relationships." As such, assessing students on this standard would require teachers to adopt new instructional and assessment strategies.

Similarly, if any one of the terms "communicate," "explain," or "justify" were used in a standard, then teachers would need to have their students explain or write their solutions or ideas to a mathematical problem in order for the teacher to assess the student's ability to "explain" or "justify."

Leaving out content specifics

Leaving out content specifics was a strategy that evolved slowly throughout the yearlong effort to develop standards. Over time, the mathematics writing team decided that they did not want to provide a set of standards that could be interpreted as "finished" or ready to implement "as is." Therefore, standards were written broadly and mathematics content was reduced so that those at the local level would be required to engage in standard setting themselves. This strategy was used to provide both flexibility in classroom practice and to encourage teachers to engage in curriculum development at the local level. The writing team wanted to change teachers' views of mathematics and their teaching, but not necessarily to develop an official statewide K-12 curriculum. In essence, the writing team viewed the mathematics standards more as a professional development tool rather than an "authoritative" document delineating what students should know and be able to do.

Avoiding words which could dissuade teacher change

The writing team was also concerned over the inclusion of certain words or phrases in the standards. Terms commonly associated with "computation" were rarely included lest the standards encourage a "traditional" view of mathematics. Interestingly, the word "algebra" was another example of a term several writers felt might work against their goals for the standards. They felt that the term "algebra" carried undesirable baggage by conjuring up images such as "algebra as a course" with a "predetermined set of skills to be mastered" and "algebra as symbolic manipulation." (writing team characterizations) The first few drafts included the term algebra in the strand: *Relationships and Algebra* (July 1994), *Algebraic Concepts and Operations* (Sept. 1994), and *Algebraic Thinking* (Nov. 1994). However, the final draft (March 1995) did not contain any references to algebra at all in either the strand (newly renamed *Patterns, Functions, and Relations*) or the standards.

Many of the writing team members were sensitive to writing standards that might not challenge the traditional view of algebra or how it should be taught. The team was wary of the messages that might be conveyed depending on how the algebra standards were written. As a result, the Algebra standards were reduced in number and written more broadly over time. The writer's felt that this would encourage more flexibility in designing algebra courses and to send the message that algebra should be viewed through "big ideas" and not as a set of isolated skills.

The evolution of the Algebra standards provides insight into the overall strategies of the writing team. Below is a comparison between the September

1994 and March 1995 Rough Drafts of the Algebra standards at the high school level. There is a noticeable reduction of content specifics and number of standards.

September 1994

- Recognize, describe, extend, estimate, analyze, generalize, transform and create a wide variety of mathematical relationships by using models such as tables, graphs (both one- and two-dimensional), matrices, verbal rules, expressions, equations and inequalities;
- Translate among tabular, symbolic and graphical representations of functions and relationships;
- Solve equations and inequalities of varying degrees using graphing calculators and computers as well as appropriate paper-and-pencil techniques;
- Recognize that a variety of problem situations can be modeled by the same type of function or relationship;
- Solve systems of equations and inequalities graphically and algebraically based on real-world and mathematical problem situations;
- Translate problem solving situations into expressions, equations, and inequalities that use a variable;
- Analyze and use functional relationships in problem solving situations;
- Explain the logic and purpose of algebraic procedures.

March 1995

By March 1995, these eight standards evolved to the following four standards:

- Demonstrate an understanding of the use of expressions, equations, inequalities, tables, graphs and matrices to solve real world and mathematical problems;
- Analyze and use functional relationships to model real-world phenomenon;
- Represent problem situations using discrete structures such as finite graphs, matrices, sequences and series;
- Investigate the effects of parameter changes on functions.

In general, the algebra standards are reflective of the writing team's more general effort to convey their views of mathematics education reform and of their concern over the interpretation and use of the standards.

The political context changes

In late fall 1994 the political context changed rapidly with the election of a new education commissioner who called for a strong accountability system based on new content standards and statewide testing. Shortly afterwards, Florida DOE officials decided that the recently developed standards in mathematics and language arts would be used as the basis for the state's new testing program.

The writing team's initial reaction to statewide testing

The mathematics writing team was concerned over the DOE's decision to use the new standards as the basis for statewide testing. Since the standards were written to facilitate, not determine, curriculum development at the local level, the writing team felt their goals for the standards would be usurped if used for state testing.[2] In reaction, the mathematics team rewrote approximately one-third of the standards since they felt that statewide tests based on the standards could betray their attempts to reform mathematics education. The mathematics writing team removed verbs they felt that might lead to "traditional" testing and replaced them with verbs that were more difficult to assess. Table 1 provides examples of changes to the mathematics standards.

Before	After
Compare and order whole numbers and commonly used fractions.	Communicate an understanding of the order of whole numbers and commonly used fractions.
Use and describe the concepts of length, capacity, weight, perimeter, area, time, temperature, and angle.	Construct meaning for length, capacity, weight, area, time, temperature, and angle.
Use real-life experiences and physical materials to describe, classify, compare, sort, model, draw and construct 2- and 3-dimensional shapes	Explore the attributes of 2- and 3-dimensional shapes.
Identify and use geometric shapes in various non-standard orientations involving transformations, manipulatives, and drawings.	(a) Develop spatial sense by exploring transformations on geometric shapes; and (b) Explore patterns of geometric shapes such as tessellations and symmetry to discover attributes of geometric shapes.
Recognize, describe, extend, generalize, and create a wide variety of patterns.	Explore a wide variety of patterns and relationships.
Compare and order whole numbers, commonly used fractions, and decimals and explore their inter-relationships.	Investigate the order of whole numbers, commonly used fractions, and decimals, and explore their inter-relationships.

Note: Underlined words show changes

***Table 1**: Examples of changes to mathematics standards due to assessment concerns*

Revising the standards

In March 1995 Florida DOE officials decided that the new standards were inappropriate to serve as a basis for the state's emerging accountability program and chose to revise them. In general, the standards were criticized by state

[2] The mathematics writing team was not in a consensus on this issue. Several writers wanted the standards to influence the direction of state assessment.

officials as (a) too broad and vague, (b) written more like classroom activities than statements of knowledge and skills, and (c) did not adequately address the basics (e.g., computational skills). Despite the changes in the political context, however, the mathematics writing team decided to try to maintain as much of their original goals for the standards as possible. This resulted in numerous debates and struggles between the mathematics writing team and state officials.

The writing team's response to criticisms

When the mathematics standards were criticized for being too broad and vague, the writing team defended themselves by explaining that although the standards were now to be used as a basis for state testing, they were also for classroom instruction and they wanted to preserve a set of standards that provided for local flexibility. In addition, the writing team disagreed that their choice of action verbs such as "communicate," "describe," or "analyze" turned standards into classroom activities. In particular, the writing team did not want to forgo their goal of using the standards to promote changes in pedagogy and classroom assessment practices.

Although compromising on many issues, the mathematics writing team felt that many of the changes suggested by the DOE ran contrary to their goals. As a result, the writing team developed a variety of strategies which allowed them to "cover the basics" and "please the critics" while still maintaining their original intent for the standards. Three of these strategies included: (1) keeping the number of standards to a minimum so they would have to be written broadly, (2) using performance descriptors to influence the interpretation of a standards, and (3) playing what the editor referred to as "Number Games." Strategy (1) follows from the original effort of the writing team. The fewer the standards, they broader they had to be written in order to "cover" K-12 expectations. Strategies (2) and (3) are specific to the revision process and will be explored below in more detail.

Performance descriptors

The performance descriptors[3]– despite being only examples—were considered an integral aspect of interpreting the standards. This was particularly true for standards that DOE officials found "vague," or those standards written more "traditional" than the writing teams wished, or even to those standards that the DOE felt were inappropriate or "too sophisticated" for students. For example with respect to the following PreK-2 benchmark:

> Analyzes real-world data by surveying a sample space and predicting the generalization onto a larger audience through the use of appropriate technology, including calculators and computers.

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[3] Performance Descriptors were examples of classroom activities demonstrating how a standard could be accomplished.

The mathematics writing team included the following performance descriptor to help with its interpretation:

> *Achievement of the benchmark may be demonstrated when the student:*
>
> ... takes a class survey and records results in a chart and/or pictograph. The student makes a prediction of schoolwide responses to the same survey using calculators to facilitate working with large numbers.
>
> Example: The student goes to the parking lot to count and record the number of manatee and panther license tags. The student then generalizes from this survey to predict how many manatees and panther license tags exist in the state.

As a result, despite objections by numerous reviewers and DOE officials that this standard was too complicated for K-2, the standard was accepted in the final version due to the influence the performance descriptor had over how reviewers "interpreted" the standard.

Number games

"Number Games" referred to making changes mostly to the standards in the Number and Measurement strands such as including more specificity, a greater number of standards, and more of the "basics." This strategy was buttressed by the writing team's perception of the lack of mathematical knowledge of the DOE and many reviewers. The mathematics editor felt she was seen as the expert and therefore was better able to fend off changes to topics such as Geometry, Algebra, and Data Analysis which were not familiar to most reviewers who do not have a strong mathematics background. These strategies led to some unusual characteristics in Florida's mathematics standards. For example, the Number and Measurement standards are much more specific and numerous. Even at the high school level, there are more standards for Number and Measurement (20) than for Algebra, Geometry and Data Analysis combined (16). Overall, there are 45 standards in the Number strand alone while only 16 in Algebra for all of K-12.

Discussion

This research provides insight into the political nature of standards development in one US state. Florida's mathematics writing team felt the standards were an opportunity to reform mathematics education and to influence state and local policies. However, once the decision was made to revise the standards due to changes in the political context, the history and philosophy of the original effort to develop standards continued and served as a starting point for revisions. Thus, the original goals of the standards strongly influenced how they were later revised to serve the new state testing expectations.

Florida's mathematics standards were imbued with greater intent and meaning than what appeared to those not on the writing team, and although not always explicit, was the primary cause for many of the debates. To understand Florida's mathematics standards requires one to understand the agenda of its

writers. As we can see, standards are not only a reflection of the type of reform efforts adopted by a state, but of the goals and philosophies of those individuals who participate in mathematics standards development.

Note to Conference Participants: Florida is currently revising their standards. What changes are being made and why they are being made will be discussed at this presentation.

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